

REMARKS

Claims 1-6 are pending.

Applicants thank the Examiner for withdrawing the previous obviousness rejections.

CLAIM REJECTIONS

Rejection under 35 U.S.C. § 112, first paragraph

The Examiner has rejected claims 1-6 under U.S.C. § 112, first paragraph for lack of enablement. See Office Action at p. 2. Claims 2-3 depend from independent claim 1 and claims 5-6 depend from independent claim 4. Specifically, the Examiner states that the specification “does not reasonably provide enablement for using any alkoxyalkyl cation as the chemical ionization precursor, especially long chain alkoxyalkyls.” *Id.* The Examiner further contends that “it would require undue experimentation for a routineer in the art to perform the method in the scope of the claims with every alkoxyalkyl cation chemical ionization precursor.” *Id.*

In addition, the Examiner also contends that the claims are not enabled because the specification “does not reasonably provide enablement for detecting an arbitrary molecule within a gas sample containing alkanes, ethane or ethyne.” See Office Action at p. 3. The Examiner states that it would require undue experimentation as “there is no indication for success of the method in terms of any arbitrary molecule having a reactive species.” *Id.*

MPEP 2164.01(a) states that

[t]he determination that ‘undue experimentation’ would have been needed to make and use the claimed invention is not a single, simple factual determination. Rather, it is a conclusion reached by weighing all the above noted factual considerations. *In re Wands*, 858 F.2d at 737, 8 USPQ2d at 1404.

Applicants submit that the Examiner has not considered any of the *Wands* factors and respectfully disagrees with the Examiner’s conclusion that the claims are not enabled.

In response to the first enablement rejection, the specification provides examples of using methoxymethyl cations on pages 3-5 of the specification. MPEP 2164.01(b) states that

[a]s long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement of 35 U.S.C. 112 is satisfied. *In re Fisher*, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970).

Applicants submit that a person of skill in the art of chemical ionization mass spectrometry would be able to select the appropriate alkoxyalkyl precursor to be used in the methods described in claims 1 and 4 without any undue experimentation. For example, a person of skill in the art would know that the reactions of $\text{CH}_3\text{OCH}_2^+$ with $\text{C}_2\text{H}_5\text{OH}$, CH_3COCH_3 are almost identical to the reactions of $\text{C}_2\text{H}_5\text{OCH}_2^+$ (an alkoxyalkyl cation) with $\text{C}_2\text{H}_5\text{OH}$, CH_3COCH_3 . These alkoxyalkyl cations have similar rate coefficients and product distributions. See HE Audier and TB McMahon, *J. Mass Spectrom.* 1997, 32, 201-208.

Therefore, it would not be undue experimentation for a person of skill in the art to extend the reactions of methoxymethyl cations to alkoxyalkyl cations for the reactions with S-containing molecules and anticipate that the reactions of simple alkoxyalkyl cations would behave similarly with S-containing molecules as they do with the methoxymethyl cation. The precedents are in the literature for reactions of simple alkoxyalkyl cation reactions with other common molecules. See for example, HE Audier and TB McMahon, *J. Mass Spectrom.* 1997, 32, 201-208.

With respect to the second enablement rejection, Applicants again submit that a person of skill in the art of chemical ionization mass spectrometry would be able to detect and quantify trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethane or ethyne. Contrary to the Examiner's assertions, the method does not detect just any arbitrary molecule having a reactive species. Claims 1 and 4 both describe a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer. The specification again describes how to do so on pages 3-5.

Accordingly, Applicants have informed and demonstrated to a person having ordinary skill in the art how to use the invention commensurate in scope with the claims. As such, Applicants respectfully request reconsideration and the withdrawal of this rejection with respect to claims 1-6.

Rejection under 35 U.S.C. § 112, second paragraph

The Examiner has rejected claim 6 under U.S.C. § 112, second paragraph, as being indefinite. See Office Action at p. 3. Specifically, the Examiner contends that claim 6

"contradicts the statements of amended claims 1 and 4 that the ionization precursor must not react with the major components of air." Id. Claim 6 depends from independent claim 4.

Claim 4 relates to a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer wherein the alkoxyxymethyl cations do not react with the major components of air, nor with the gas or the gas mixtures containing alkanes, ethene or ethyne but reacts with the trace levels of molecules to be detected. Claim 6 further describes wherein the range of reactive species includes molecules that contain sulphur, nitrogen, oxygen, phosphorus or silicon heteroatoms.

Applicants have specified that the range of reactive species includes molecules that contain sulphur, nitrogen, oxygen, phosphorus or silicon heteroatoms. Air does not contain heteroatoms of these elements. Oxygen and nitrogen are homogeneous gasses and do not contain heteroatoms.

Applicants believe that claim 6 is not indefinite and does not contradict independent claim 4. Claim 6 as a whole would appraise one of ordinary skill in the art of its scope. Applicants respectfully request reconsideration and the withdrawal of this rejection.

Rejection under 35 U.S.C. § 103

Freitas

The Examiner has rejected claims 1-6 under 35 U.S.C. § 103(a) as being unpatentable over Freitas et al. (*Int J Mass Spectrom.*, Vol. 175, p. 107-122 (1998)) ("Freitas"). See Office Action at p. 4. Claims 2-3 depend from independent claim 1 and claims 5-6 depend from independent claim 4.

Claim 1 describes a method of detecting and quantifying trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne, said method including using an alkoxyalkyl cation as the chemical ionization precursor in a selected ion flow tube mass spectrometer wherein the chemical ionization precursor does not react with the major components of air, nor with the gas or the gas mixtures containing alkanes, ethene or ethyne but reacts with the trace levels of molecules to be detected.

Claim 4 describes a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer that include the steps of: producing a supply of alkyoxymethyl cations, mass selecting the alkyoxymethyl cations, inducing a flow of the alkyoxymethyl cations into the inlet of a flow tube of the spectrometer in a carrier flow of helium reacting the gas sample with the alkyoxymethyl cations, analysing the reacted gas sample in the mass spectrometer, and calculating the concentration of the trace levels of molecules containing heteroatoms present in the reacted gas sample wherein the alkyoxymethyl cations do not react with the major components of air, nor with the gas or the gas mixtures containing alkanes, ethene or ethyne but reacts with the trace levels of molecules to be detected.

The Examiner contends that “*applicants admitted prior art*” and that it would have been obvious to a person of ordinary skill in the art “to detect a molecule containing a sulfur heteroatom in a gas sample containing alkanes because Freitas discloses that the methoxymethyl cation reacts with sulfur containing molecules but not alkanes (*Table 2*).” See Office Action at p. 4. Firstly, Applicants do not admit anywhere in the specification that Freitas is “prior art.” Rather, Applicants presented “previous experimental work” to provide background information in the specification.

Secondly, Applicants do not agree that “Freitas discloses a method of detecting molecules using a methoxymethyl cation as a chemical ionization precursor … and is known to react with sulfur containing species, but not with alkanes.” See Office Action at p. 4.

Freitas describes the “gas phase reactivity of the methoxymethyl cation … towards 21 neutral nucleophiles” See abstract of Freitas. Freitas presents that the methoxymethyl cation reacts with 4 molecules that contain sulfur and one hydrocarbon for which a reaction occurs. See Table 2 of Freitas. The only hydrocarbon that Freitas includes is benzene. Id. Freitas does not describe that methoxymethyl cation reacts with sulfur containing molecules but not alkanes. Based on the experimental data in Table 2 of Freitas, one of skill in the art would interpret Freitas to indicate that methoxymethyl cation reactions with both sulfur-containing molecules and hydrocarbons.

Applicants also request the consideration of a Declaration under 37 CFR § 1.132 from Murray J. McEwan ("the McEwan declaration," attached at Exhibit A).

The McEwan declaration states that

[o]ne of the first papers on the reactions of the methoxymethyl cation using SIFT was published by our group, Wilson et al in 1994 (*Int J Mass Spectrom. Ion Proc.*, 1994, 132, 149-152). In that paper we examined the reactions of $\text{CH}_3\text{COCH}_2^+$ with nitrogen bases and achieved reasonable overlap in compounds (but not results) studied in Freitas reference as the Freitas reference also published results from several nitrogen bases. The second paper was also a paper from our group, Wilson et al, *Mass Spec.*, 2002, Vol. 13, p. 1028-1033 ("Wilson"), in which we measured the reactions of nitrogen bases as well as sulfur compounds and hydrocarbons. In that Wilson reference, we showed that quite a number of the rate coefficients published by Freitas reference were incorrect (see Table 1 of Wilson).

The Freitas reference claims a rapid reaction of $\text{CH}_3\text{OCH}_2^+$ and H_2S (Table 2 of Freitas) while the Wilson reference shows there is in fact no reaction ($k < 5 \times 10^{-13} \text{ cm}^3 \text{ s}^{-1}$). That represents an error of 4 orders of magnitude. A glance at Table 1 in Wilson shows that for most reactions where overlap occurs between Wilson and Freitas references, the Freitas reference results are in error by around a factor of 2.

The only hydrocarbon reactant that the Freitas reference measured with $\text{CH}_3\text{OCH}_2^+$ was C_6H_6 and a fast reaction was reported ($1.9 \times 10^{-9} \text{ cm}^3 \text{ s}^{-1}$). The Wilson reference reported a much slower reaction ($4.9 \times 10^{-10} \text{ cm}^3 \text{ s}^{-1}$) and showed that there was no reaction of $\text{CH}_3\text{OCH}_2^+$ with small straight chain hydrocarbons but fast reactions occurred with odorant hydrocarbons CH_3SH , $\text{C}_2\text{H}_5\text{SH}$, $(\text{CH}_3)_2\text{SH}$. With findings based on the Freitas reference alone, it would be reasonable to assume that reactions of $\text{CH}_3\text{OCH}_2^+$ occur with hydrocarbons.

See paragraphs 6-8 of the McEwan Declaration.

Accordingly, Freitas does not teach or suggest a method of detecting and quantifying a gas sample containing trace levels of molecules containing one or more of a range of reactive species in gases or gas mixtures containing alkanes, ethene, or ethyne in a selected ion flow tube mass spectrometer wherein the alkyoxymethyl cations do not react with the major components of air, nor with the gas or the gas mixtures containing alkanes, ethene or ethyne but reacts with the trace levels of molecules to be detected as described in claims 1 and 4.

There is no motivation or suggestion in Freitas to modify the methods described in the above-cited references to arrive at the method described in claims 1 or 4. Accordingly, claims 1 and 4 and claims that depend therefrom are patentable over Freitas for at least the reasons

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described above. Applicants respectfully request reconsideration and withdrawal of this rejection

CONCLUSION

Applicant believes that the claims are in condition for allowance. A petition for an extension of time is attached.

Should any fees be required by the present Reply, the Commissioner is hereby authorized to charge Deposit Account 19-4293.

Respectfully submitted,

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